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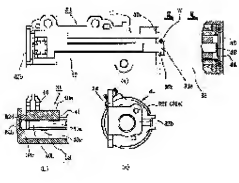
(54) **STEPPING MOTOR**



(57)Abstract:

PURPOSE: To apply a proper pressure to a shaft and at the same time to maintain the spring performance of a thrust spring properly by welding and fixing an intermediate bearing to a frame.

CONSTITUTION: A resin bearing 34b is lightly press-fitted into a fitting hole 32b provided at a frame 32 and a metal bearing 34a is fitted into a fitting hole 32c. Then, a yoke assembly is laid out at the base edge part side in the axial direction and the metal bearing 34a is inserted into a diameter-reduced part but the opening side of a case body 33 is laid out so that it faces the frame 32

and does not contact a bent piece 32a. Then, the total length from a reference surface to the bent piece 32b is determined with the reception surface of a thrust spring 42 as a reference. Also, aligning with the inner diameter of the innermost periphery surface of a yoke assembly is performed following the inner diameter of a metal bearing 34a and a resin bearing 34b and then the metal bearing 34a is welded and fixed W to the frame 32 in three directions by laser welding positioning it on the aligned axis.

CLAIMS

[Claim(s)]

[Claim 1]A frame which extended to shaft orientations of a motor, and a stator of the shape of a barrel arranged at the axial end part side of this frame, It has a rotor allocated in this stator, and a shaft which extended from this rotor, This shaft is inserted in in an intermediate bearing with which a stator flank of the above-mentioned frame was equipped, and that end part is contacted by thrust block and supported movably, enabling free rotation, A stepping motor which carries out having carried out welding immobilization of the intermediate bearing to the above-mentioned frame with the feature in a stepping motor with which the other end was contacted by thrust spring, and load of the thrust precompression was carried out.

[Claim 2]The stepping motor according to claim 1, wherein said intermediate bearing is sintering metal bearing.

[Claim 3]The stepping motor according to claim 1 or 2, wherein said welding is laser welding.

[Claim 4]The stepping motor according to any one of claims 1 to 3, wherein said stator has composition which does not contact a frame.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention relates to the stepping motor which improved the thrust precompression load structure of the shaft which started the stepping motor, especially extended from the rotor.

[0002]

[Description of the Prior Art]For example, the stepping motor is adopted as a driving means of the zoom lens of OA equipment or a video camera, and a focus lens. This is because it has the characteristic that a stepping motor can accomplish position control and speed control easily with a digital signal, and is cheap, and a miniaturization is also easy.

[0003]Drawing 9 shows an example of the conventional PM type stepping motor. The frame 2 of the stepping motor 1 has extended to the shaft orientations of the motor concerned as illustrated.

The axial cross section is presenting the U shape.

The case body 3 which presents the shape of a cylinder-like-object-with-base object is attached to the axial end part of this frame 2.

[0004]In this case body 3, the yoke assembly 4 (stator) which presents the shape of a cylinder body is stored. This yoke assembly 4 carries out integral moulding of 4 sets of pole gear yokes with resin, for example, and is formed. And the two coils 5a and 5b are formed in this yoke assembly 4, and that periphery is covered with it by the above-mentioned case body 3, for example.

[0005]In this yoke assembly 4, the rotor 8 which the magnet 7 is attached on the periphery by the side of the base end of the shaft 6, and changes is allocated. Around the magnet

7, the predetermined gap G is formed between the inner skin of the above-mentioned yoke assembly 4. Therefore, the above-mentioned shaft 6 will rotate by the revolving magnetic field to generate by switching in order the current sent through the above-mentioned coils 5a and 5b. This shaft 6 has extended from the rotor 8 to the above-mentioned frame 2, and the leading screw 6a is formed in the extension side peripheral part of this shaft 6. And the shaft 6 is supported movably by the bearings 9a and 9b at the both ends of the leading screw 6a, enabling free rotation.

[0006]The axial both ends of the above-mentioned frame 2 are equipped with these bearings 9a and 9b. The bearing 9a which supports movably the base end side of the above-mentioned shaft 6 is formed of the metal bearing which presents the shape of a cylinder body. Namely, the above-mentioned shaft 6 is inserted in in the metal bearing 9a, enabling free rotation. On the other hand, the bearing 9b which supports the extension end of the above-mentioned shaft 6 movably is formed of the PIPOTTO bearing.

[0007]And to the leading screw 6a of the above-mentioned shaft 6, the geared parts 11a and 11b of the connecting part 11 have geared, and the connecting part 11 moves to the above-mentioned shaft orientations by rotation of the shaft 6 concerned. And the above-mentioned frame 2 is built over the sub-guide axis 12 along with the above-mentioned shaft 6 that movement of this connecting part 11 should be guided, and adhesion fixing of that insertion section is carried out to the frame 2.

[0008]The thrust pad 13 is contacted by the base end of the above-mentioned shaft 6, and load of the thrust precompression is carried out within the case body 3 by closing the opening of the above-mentioned case body 3 with the pressure plate 15 via the thrust spring 14.

[0009]

[Problem(s) to be Solved by the Invention]By the way, if it

is in the conventional stepping motor 1, In order to carry out load of the suitable thrust precompression for the above-mentioned shaft 6, the dimensional accuracy of each part article unit of the frame 2, the bearings 9a and 9b, the case body 3, the yoke assembly 4, and rotor 8 grade needed to be set up severely, and there was a problem that its manufacture and assembly cost increased.

[0010]Although the load rate of the thrust spring 14 interposed between the thrust pad 13 and the pressure plate 15 within the above-mentioned case body 3 is set up small and there are also measures of taking the large amount of displacement, When according to this the installation nature at the time of an assembly (fixed) worsened and a shock was added, there was a problem that the spring performance of the thrust spring 14 declined.

[0011]In view of an aforementioned problem, the purpose of this invention is an easy and cheap assembly, and can carry out load of the suitable thrust precompression for a shaft, and there is in providing the stepping motor which can maintain spring performance good.

[0012]

[Means for Solving the Problem]A frame which extended to shaft orientations of a motor according to the stepping motor which the above-mentioned purpose requires for this invention, A stator of the shape of a barrel arranged at the axial end part side of this frame, and a rotor allocated in this stator, Have a shaft which extended from this rotor, this shaft is inserted in in an intermediate bearing with which a stator flank of the above-mentioned frame was equipped, and that end part is contacted by thrust block and supported movably, enabling free rotation, In a stepping motor with which the other end was contacted by thrust spring, and load of the thrust precompression was carried out, it is attained by having carried out welding immobilization of the intermediate bearing at the above-mentioned frame.

[0013]In the above-mentioned composition, the above-mentioned intermediate bearing consists of sintering metal bearing preferably.
[0014]The above-mentioned welding is preferably made in laser welding.
[0015]Preferably, it is constituted so that the above-mentioned stator may not contact a frame.
[0016]
[Function]According to the above-mentioned composition, the shaft of the above-mentioned rotor is supported movably by the thrust block and the intermediate bearing, enabling free rotation. The end part of this shaft is contacted by the thrust block, and that other end is contacted by the thrust spring. That is, load of the thrust precompression is carried out to a shaft by this thrust spring. The stator flank of the above-mentioned frame is equipped with the intermediate bearing, and welding immobilization of this intermediate bearing is carried out at the frame. Therefore, by preventing gap from the frame of an intermediate bearing, and the end part of the above-mentioned shaft being contacted by the thrust block, and positioning it, an assembly becomes easy and load of the suitable thrust precompression for a shaft is carried out.
[0017]If sintering metal bearing is adopted as the above-mentioned intermediate bearing, welding immobilization will be attained, the sizing will also become easy, and an assembly will become easier.
[0018]If laser welding is adopted as the above-mentioned welding, the thermal effect and material modification which precise welding into a detailed portion is attained, and are given to a weld zone will decrease.
[0019]And the above-mentioned stator did not contact a frame but this stator and the bearing assembly have broken off their relationship. Therefore, the assembly size error of a stator does not have an adverse effect on the above-mentioned thrust spring, an assembly becomes easier and

load of the suitable thrust precompression for a shaft is carried out by this.

[0020]Since the above-mentioned stator and a bearing assembly break off their relationship even if a shock is added, impact load is not easily applied to a thrust spring, and spring performance is maintained good.

[0021]

[Example]Hereafter, one suitable example of this invention is described in detail based on an accompanying drawing. since the example described below is a suitable example of this invention, desirable various limitation is attached technically, but the range in particular of this invention is not restricted to these modes, as long as there is no statement of the purport that this invention is limited in the following explanation.

[0022]Drawing 1 (a), (b), and (c) shows the PM type stepping motor of this example. The frame 32 of the stepping motor 31 has extended so that the shaft orientations of the motor concerned may turn into the longitudinal direction, as illustrated. This frame 32 fabricates sheet metal, and that axial cross section is presenting the U shape as shown in drawing 2. And the mounting holes 32c and 32d aligned by the shaft orientations concerned are drilled in the pieces 32a and 32b of bending located in the axial both ends of this frame 32, respectively.

[0023]The mounting hole 32c drilled in the piece 32a of bending located in the above-mentioned shaft-orientations end face side is equipped with the intermediate bearing 34a. The metal bearing which carried out sinter molding cylindrical with powder-metallurgy processing is used for this intermediate bearing 34a, for example. welding fixed W This metal bearing 34a is used as the above-mentioned frame 32 as shown in drawing 1 (a) and drawing 2. The peripheral part of the metal bearing 34a and the inner periphery of the above-mentioned mounting hole 32c are welding fixed W

Carried out by laser welding, and specifically, welding is performed to three places of the periphery of the metal bearing 34a as shown in drawing 3.

[0024]32d of mounting holes drilled in the piece 32b of bending located in the above-mentioned shaft-orientations end face side on the other hand are equipped with the thrust block 34b. As shown in drawing 1 (b), the resin bearing fabricated by the concave is used for this thrust block 34b. The flange 34c whose diameter was expanded by the method of the outside of a diameter direction is formed in the edge part of this resin bearing 34b, and it prevents the resin bearing 34b falling out from 32d of the above-mentioned mounting holes, and coming out of it by this flange 34c.

[0025]The case body 33 is located in the piece 32a side of bending of the above-mentioned frame 32. This case body 33 is presenting the shape of a closed-end cylinder body as shown in drawing 4 (a), (b), and (b). The mounting hole 33b is established in the pars basilaris ossis occipitalis 33a of the case body 33. This mounting hole 33b has a size which the rotor mentioned later may pass.

And the pressure plate later mentioned to this is attached.

[0026]In the above-mentioned case body 33, the yoke assembly 35 (stator) which presents the shape of a cylinder body is stored as shown in drawing 5. This yoke assembly 35 carries out integral moulding of the insulator part of 4 sets of pole gear yokes with resin, for example, and is formed. And the two coils 36a and 36b were formed in this yoke assembly 35, and the case body 33 mentioned above so that this might be covered has pasted up that periphery on it, for example.

[0027]Specifically, the yoke assembly 35 is fabricated, as shown in drawing 6. First, it holds using the metallic mold K1 and K2 as shown in drawing 6 (b) as opposed to 4 sets of pole gear yokes 35a as shown in drawing 6 (a). The metallic mold K1 changes so that it may open and close in the

direction of arrow A and the metallic mold K2 may be slid in the direction of arrow B. Here, winding is given, and the metallic mold K1 and K2 are formed in the coils 36a and 36b, the portion which changes, and the inner periphery surface part in which the rotor 37 mentioned later will be inserted so that the resin injection space S1 and S2 may be obtained. And outsert molding is performed in this state. That is, resin is poured in to the resin injection space S1 and S2 from the resin injection gate established in the prescribed position. The resin layer formed in the resin injection space S1 is formed as insulating-layer F1 over coil winding as shown to drawing 6 (d) which is drawing 6 (c) and its enlarged vertical longitudinal sectional view by this. On the other hand, the resin layer formed in the resin injection space S2 is formed as the most-inner-circumference side F2 of the yoke assembly 35. Thus, after outsert molding is performed, terminal pin PT is pressed fit and the yoke assembly 35 is completed as shown in drawing 6 (e) and (f) in the top view and the sectional view.

[0028]Then, winding will be given, and the above-mentioned coils 36a and 36b will be formed as shown in drawing 7. The diameter reduction part 35b is formed in shaft-orientations 1 inner periphery edge of this yoke assembly 35 with resin. The inside diameter d1 of this diameter reduction part 35b is formed so that it may be abbreviated-in agreement with the outer diameter d2 of the above-mentioned metal bearing 34a. As shown in drawing 1 (a), the yoke assembly 35 is arranged so that the opening side of the above-mentioned case body 33 may attend the frame 32, and so that this yoke assembly 35 may not contact the above-mentioned piece 32a of bending.

[0029]And the rotor 37 is allocated in this yoke assembly 35. On the periphery by the side of the base end of the shaft 38, this rotor 37 attaches two or more magnets 39, and is formed. After the two cylindrical magnets' 39

separating a prescribed interval to shaft orientations and specifically insuring alignment and height deciding them at the base end side of the shaft 38 as shown in drawing 8 (a) and (b), adhesion fixing is carried out, and 12 pole magnetization is carried out. On the other hand, the extension end of this shaft 38 is formed by cutting etc., for example so that it may have the curvature faces R, such as a surface of a sphere. The outer diameter of the extension end of this shaft 38 is formed so that it may be abbreviated-in agreement with the inside diameter of the above-mentioned resin bearing 34b.

[0030]Around the above-mentioned magnet 39, the predetermined gap G is formed between the inner skin of the above-mentioned yoke assembly 35. Therefore, the above-mentioned shaft 38 will rotate by the revolving magnetic field to generate by switching in order the current sent through the above-mentioned coils 36a and 36b.

[0031]And this shaft 38 has extended from the rotor 37 to the above-mentioned frame 32, and the leading screw 38a is formed in the extension side peripheral part of this shaft 38. And the shaft 38 is supported movably by the above-mentioned metal bearing 34a and the resin bearing 34b at the both ends of the leading screw 38a, enabling free rotation.

[0032]The leading screw 38a is formed in the extension side of the above-mentioned shaft 38, and the geared parts 40a and 40b of the connecting part 40 have geared to this leading screw 38a. And the above-mentioned frame 32 is inserted in and built over the sub-guide axis 41 in parallel with the shaft 38. Light pressure ON of this sub-guide axis 41 is carried out to the pores 32e and 32f provided in the frame 32, and it is being fixed by adhesives. This sub-guide axis 41 is inserted in the above-mentioned connecting part 40. Therefore, with rotation of the shaft 38, the connecting part 40 will be guided in accordance with the sub-guide axis 41, and slide movement

of the leading-screw 38a top will be carried out to shaft orientations. The inside 40c of drawing 1 is the spring material attached in order to keep good the meshing state of the gear parts 40a and 40b and the leading screw 38a.

[0033]The above-mentioned connecting part 40 is a portion connected with the flexible region which drives with the stepping motor 31. For example, when a video camera is equipped with the stepping motor 31 of this example, a lens holder is connected with this connecting part 40, and a zoom lens and a focus lens are moved.

[0034]As shown in drawing 1 (a), the thrust spring 42 is contacted by the base end of the above-mentioned shaft 36, and load of the thrust precompression is carried out to it within the case body 33 by closing the mounting hole 33b of the above-mentioned case body 33 with the pressure plate 44 via the thrust pad 43.

[0035]Next, the operation is described, explaining the assembly procedure of the stepping motor of the above-mentioned example. First, as shown in drawing 1 (b), light pressure ON of the resin bearing 34b is carried out into the mounting hole 32d drilled by the above-mentioned frame 32. As shown in drawing 2, it equips with the metal bearing 34a in the mounting hole 32c drilled by the above-mentioned frame 32.

[0036]Next, the yoke assembly 35 is arranged to the shaft-orientations base end side of the above-mentioned frame 32, and the above-mentioned metal bearing 34a is inserted into the diameter reduction part 35b of this yoke assembly 35. At this time, as shown in drawing 1 (a), the yoke assembly 35 is arranged so that the opening side of the above-mentioned case body 33 may attend the frame 32, and so that this yoke assembly 35 may not contact the above-mentioned piece 32a of bending. The case body 33 has pasted the yoke assembly 35 beforehand.

Thereby, the peripheral part is covered.

[0037]And as shown in drawing 5, the overall length L from

this base level B to the piece 32b of bending of the above-mentioned frame 32 is defined on the basis of the abutment X of the thrust spring 42. Alignment is insured with the inside diameter D3 of the most-inner-circumference side F2 of the above-mentioned yoke assembly 35 on the basis of the inside diameter D1 of the above-mentioned metal bearing 34a and the resin bearing 34b, and D2, and it sets up so that these may be located on the same axle. welding fixed W In this state, as shown in drawing 1 (a) and drawing 3, make metal bearing 34a the above-mentioned frame 32 by laser welding from a three way. Thus, if laser welding is used, the thermal effect and material modification which can perform precise welding into a detailed portion, and are given to a weld zone can be lessened. Since it is using sintering metal bearing as the intermediate bearing 34a, this example can perform welding immobilization, is easy also for the sizing and can perform an assembly more easily.
[0038]Then, in the yoke assembly 35, the mounting hole 33b of the case body 33 is passed, and the rotor 37 is arranged. The shaft 38 of this rotor 37 is inserted in the above-mentioned metal bearing 34a, and that extension end is contacted by the above-mentioned resin bearing 34b. Therefore, the metal bearing 34a with which the pieces 32a and 32b of bending of the above-mentioned frame 32 were equipped, respectively, and the resin bearing 34b will support movably the both ends of the leading screw 38a formed in the above-mentioned shaft 38, enabling free rotation. Since the extension end of the above-mentioned shaft 38 is formed so that it may have the curvature faces R, such as a surface of a sphere, these curvature faces R will contact the above-mentioned thrust spring 43, and rotation of the above-mentioned shaft becomes smooth.
[0039]Next, as shown in drawing 1 (a), the thrust spring 42 makes the base end of the above-mentioned shaft 36 contact, and the mounting hole 33b of the above-mentioned case body 33 is closed with the pressure plate 44 via the thrust pad

43 to it. That is, load of the thrust precompression is carried out to the shaft 38 by this thrust spring 42 within the case body 33.

[0040]It is made to insert in the above-mentioned frame 32, making the above-mentioned sub-guide axis 41 insert in the connecting part 40, and adhesion fixing of the insertion section is carried out to the frame 32. The geared parts 40a and 40b of the connecting part 40 are meshed to the leading screw 38a of the above-mentioned shaft 38, and the above-mentioned stepping motor 31 is completed. Grease is applied to the leading screw 38a.

[0041]welding fixed W As mentioned above, the metal bearing 34a on the frame 32 by carrying out, By preventing gap from the frame 32 of the metal bearing 34a, and the end part of the above-mentioned shaft 32 being contacted by the resin bearing 34b, and positioning it, an assembly becomes easy and load of the suitable thrust precompression for the shaft 38 is carried out.

[0042]The above-mentioned yoke assembly 35 did not contact the piece 32a of bending of the above-mentioned frame 32, but this yoke assembly 35 and the bearing assembly have broken off their relationship. Therefore, the assembly size error of the yoke assembly 35 cannot have an adverse effect on the above-mentioned thrust spring 42, and an assembly can simplify more also by this. Therefore, load of the suitable thrust precompression for a shaft can be carried out, there is no variation in thrust precompression, and the rotation stable in low-loss can be obtained. Since the above-mentioned yoke assembly 35 and the bearing assembly have broken off their relationship and impact load is not easily applied to the thrust spring 42 even if a metaphor shock is added, the spring performance of a thrust spring is maintainable good.

[0043]

[Effect of the Invention]As stated above, according to the stepping motor concerning this invention, an assembly is

easy and cheap, load of the suitable thrust precompression to a shaft can be performed easily, and the rotation stable in low-loss by this can be obtained. The spring performance of a thrust spring is maintainable good.

TECHNICAL FIELD

[Industrial Application]This invention relates to the stepping motor which improved the thrust precompression load structure of the shaft which started the stepping motor, especially extended from the rotor.

PRIOR ART

[Description of the Prior Art]For example, the stepping motor is adopted as a driving means of the zoom lens of OA equipment or a video camera, and a focus lens. This is because it has the characteristic that a stepping motor can accomplish position control and speed control easily with a digital signal, and is cheap, and a miniaturization is also easy.

[0003]Drawing 9 shows an example of the conventional PM type stepping motor. The frame 2 of the stepping motor 1 has extended to the shaft orientations of the motor concerned as illustrated.

The axial cross section is presenting the U shape.

The case body 3 which presents the shape of a cylinder-like-object-with-base object is attached to the axial end part of this frame 2.

[0004]In this case body 3, the yoke assembly 4 (stator) which presents the shape of a cylinder body is stored. This yoke assembly 4 carries out integral moulding of 4 sets of pole gear yokes with resin, for example, and is formed. And the two coils 5a and 5b are formed in this yoke assembly 4, and that periphery is covered with it by the above-mentioned case body 3, for example.

[0005]In this yoke assembly 4, the rotor 8 which the magnet 7 is attached on the periphery by the side of the base end of the shaft 6, and changes is allocated. Around the magnet 7, the predetermined gap G is formed between the inner skin of the above-mentioned yoke assembly 4. Therefore, the above-mentioned shaft 6 will rotate by the revolving magnetic field to generate by switching in order the current sent through the above-mentioned coils 5a and 5b. This shaft 6 has extended from the rotor 8 to the above-mentioned frame 2, and the leading screw 6a is formed in the extension side peripheral part of this shaft 6. And the

shaft 6 is supported movably by the bearings 9a and 9b at the both ends of the leading screw 6a, enabling free rotation.

[0006]The axial both ends of the above-mentioned frame 2 are equipped with these bearings 9a and 9b. The bearing 9a which supports movably the base end side of the above-mentioned shaft 6 is formed of the metal bearing which presents the shape of a cylinder body. Namely, the above-mentioned shaft 6 is inserted in in the metal bearing 9a, enabling free rotation. On the other hand, the bearing 9b which supports the extension end of the above-mentioned shaft 6 movably is formed of the PIPOTTO bearing.

[0007]And to the leading screw 6a of the above-mentioned shaft 6, the geared parts 11a and 11b of the connecting part 11 have geared, and the connecting part 11 moves to the above-mentioned shaft orientations by rotation of the shaft 6 concerned. And the above-mentioned frame 2 is built over the sub-guide axis 12 along with the above-mentioned shaft 6 that movement of this connecting part 11 should be guided, and adhesion fixing of that insertion section is carried out to the frame 2.

[0008]The thrust pad 13 is contacted by the base end of the above-mentioned shaft 6, and load of the thrust precompression is carried out within the case body 3 by closing the opening of the above-mentioned case body 3 with the pressure plate 15 via the thrust spring 14.

EFFECT OF THE INVENTION

[Effect of the Invention]As stated above, according to the stepping motor concerning this invention, an assembly is easy and cheap, load of the suitable thrust precompression to a shaft can be performed easily, and the rotation stable in low-loss by this can be obtained. The spring performance of a thrust spring is maintainable good.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]By the way, if it is in the conventional stepping motor 1, In order to carry out load of the suitable thrust precompression for the above-mentioned shaft 6, the dimensional accuracy of each part article unit of the frame 2, the bearings 9a and 9b, the case body 3, the yoke assembly 4, and rotor 8 grade needed to be set up severely, and there was a problem that its manufacture and assembly cost increased.

[0010]Although the load rate of the thrust spring 14 interposed between the thrust pad 13 and the pressure plate 15 within the above-mentioned case body 3 is set up small and there are also measures of taking the large amount of displacement, When according to this the installation nature at the time of an assembly (fixed) worsened and a shock was added, there was a problem that the spring performance of the thrust spring 14 declined.

[0011]In view of an aforementioned problem, the purpose of this invention is an easy and cheap assembly, and can carry out load of the suitable thrust precompression for a shaft, and there is in providing the stepping motor which can maintain spring performance good.

MEANS

[Means for Solving the Problem]A frame which extended to shaft orientations of a motor according to the stepping motor which the above-mentioned purpose requires for this invention, A stator of the shape of a barrel arranged at the axial end part side of this frame, and a rotor allocated in this stator, Have a shaft which extended from this rotor, this shaft is inserted in in an intermediate bearing with which a stator flank of the above-mentioned frame was equipped, and that end part is contacted by thrust block and supported movably, enabling free rotation, In a stepping motor with which the other end was contacted by thrust spring, and load of the thrust precompression was carried out, it is attained by having carried out welding immobilization of the intermediate bearing at the above-mentioned frame.

[0013]In the above-mentioned composition, the above-mentioned intermediate bearing consists of sintering metal bearing preferably.

[0014]The above-mentioned welding is preferably made in laser welding.

[0015]Preferably, it is constituted so that the above-mentioned stator may not contact a frame.

OPERATION

[Function]According to the above-mentioned composition, the shaft of the above-mentioned rotor is supported movably by the thrust block and the intermediate bearing, enabling free rotation. The end part of this shaft is contacted by the thrust block, and that other end is contacted by the thrust spring. That is, load of the thrust precompression is carried out to a shaft by this thrust spring. The stator flank of the above-mentioned frame is equipped with the intermediate bearing, and welding immobilization of this intermediate bearing is carried out at the frame. Therefore, by preventing gap from the frame of an intermediate bearing, and the end part of the above-mentioned shaft being contacted by the thrust block, and positioning it, an assembly becomes easy and load of the suitable thrust precompression for a shaft is carried out.

[0017]If sintering metal bearing is adopted as the above-mentioned intermediate bearing, welding immobilization will be attained, the sizing will also become easy, and an assembly will become easier.

[0018]If laser welding is adopted as the above-mentioned welding, the thermal effect and material modification which precise welding into a detailed portion is attained, and are given to a weld zone will decrease.

[0019]And the above-mentioned stator did not contact a frame but this stator and the bearing assembly have broken off their relationship. Therefore, the assembly size error of a stator does not have an adverse effect on the above-mentioned thrust spring, an assembly becomes easier and load of the suitable thrust precompression for a shaft is carried out by this.

[0020]Since the above-mentioned stator and a bearing assembly break off their relationship even if a shock is

added, impact load is not easily applied to a thrust spring, and spring performance is maintained good.

EXAMPLE

[Example]Hereafter, one suitable example of this invention is described in detail based on an accompanying drawing. since the example described below is a suitable example of this invention, desirable various limitation is attached technically, but the range in particular of this invention is not restricted to these modes, as long as there is no statement of the purport that this invention is limited in the following explanation.

[0022]Drawing 1 (a), (b), and (c) shows the PM type stepping motor of this example. The frame 32 of the stepping motor 31 has extended so that the shaft orientations of the motor concerned may turn into the longitudinal direction, as illustrated. This frame 32 fabricates sheet metal, and that axial cross section is presenting the U shape as shown in drawing 2. And the mounting holes 32c and 32d aligned by the shaft orientations concerned are drilled in the pieces 32a and 32b of bending located in the axial both ends of this frame 32, respectively.

[0023]The mounting hole 32c drilled in the piece 32a of bending located in the above-mentioned shaft-orientations end face side is equipped with the intermediate bearing 34a. The metal bearing which carried out sinter molding cylindrical with powder-metallurgy processing is used for this intermediate bearing 34a, for example. welding fixed W This metal bearing 34a is used as the above-mentioned frame 32 as shown in drawing 1 (a) and drawing 2. The peripheral part of the metal bearing 34a and the inner periphery of the above-mentioned mounting hole 32c are welding fixed W Carried out by laser welding, and specifically, welding is performed to three places of the periphery of the metal bearing 34a as shown in drawing 3.

[0024]32d of mounting holes drilled in the piece 32b of

bending located in the above-mentioned shaft-orientations end face side on the other hand are equipped with the thrust block 34b. As shown in drawing 1 (b), the resin bearing fabricated by the concave is used for this thrust block 34b. The flange 34c whose diameter was expanded by the method of the outside of a diameter direction is formed in the edge part of this resin bearing 34b, and it prevents the resin bearing 34b falling out from 32d of the above-mentioned mounting holes, and coming out of it by this flange 34c.

[0025]The case body 33 is located in the piece 32a side of bending of the above-mentioned frame 32. This case body 33 is presenting the shape of a closed-end cylinder body as shown in drawing 4 (a), (b), and (b). The mounting hole 33b is established in the pars basilaris ossis occipitalis 33a of the case body 33. This mounting hole 33b has a size which the rotor mentioned later may pass.

And the pressure plate later mentioned to this is attached.

[0026]In the above-mentioned case body 33, the yoke assembly 35 (stator) which presents the shape of a cylinder body is stored as shown in drawing 5. This yoke assembly 35 carries out integral moulding of the insulator part of 4 sets of pole gear yokes with resin, for example, and is formed. And the two coils 36a and 36b were formed in this yoke assembly 35, and the case body 33 mentioned above so that this might be covered has pasted up that periphery on it, for example.

[0027]Specifically, the yoke assembly 35 is fabricated, as shown in drawing 6. First, it holds using the metallic mold K1 and K2 as shown in drawing 6 (b) as opposed to 4 sets of pole gear yokes 35a as shown in drawing 6 (a). The metallic mold K1 changes so that it may open and close in the direction of arrow A and the metallic mold K2 may be slid in the direction of arrow B. Here, winding is given, and the metallic mold K1 and K2 are formed in the coils 36a and

36b, the portion which changes, and the inner periphery surface part in which the rotor 37 mentioned later will be inserted so that the resin injection space S1 and S2 may be obtained. And outsert molding is performed in this state. That is, resin is poured in to the resin injection space S1 and S2 from the resin injection gate established in the prescribed position. The resin layer formed in the resin injection space S1 is formed as insulating-layer F1 over coil winding as shown to drawing 6 (d) which is drawing 6 (c) and its enlarged vertical longitudinal sectional view by this. On the other hand, the resin layer formed in the resin injection space S2 is formed as the most-inner-circumference side F2 of the yoke assembly 35. Thus, after outsert molding is performed, terminal pin PT is pressed fit and the yoke assembly 35 is completed as shown in drawing 6 (e) and (f) in the top view and the sectional view.

[0028]Then, winding will be given, and the above-mentioned coils 36a and 36b will be formed as shown in drawing 7. The diameter reduction part 35b is formed in shaft-orientations 1 inner periphery edge of this yoke assembly 35 with resin. The inside diameter d1 of this diameter reduction part 35b is formed so that it may be abbreviated-in agreement with the outer diameter d2 of the above-mentioned metal bearing 34a. As shown in drawing 1 (a), the yoke assembly 35 is arranged so that the opening side of the above-mentioned case body 33 may attend the frame 32, and so that this yoke assembly 35 may not contact the above-mentioned piece 32a of bending.

[0029]And the rotor 37 is allocated in this yoke assembly 35. On the periphery by the side of the base end of the shaft 38, this rotor 37 attaches two or more magnets 39, and is formed. After the two cylindrical magnets' 39 separating a prescribed interval to shaft orientations and specifically insuring alignment and height deciding them at the base end side of the shaft 38 as shown in drawing 8 (a)

and (b), adhesion fixing is carried out, and 12 pole magnetization is carried out. On the other hand, the extension end of this shaft 38 is formed by cutting etc., for example so that it may have the curvature faces R, such as a surface of a sphere. The outer diameter of the extension end of this shaft 38 is formed so that it may be abbreviated-in agreement with the inside diameter of the above-mentioned resin bearing 34b.

[0030]Around the above-mentioned magnet 39, the predetermined gap G is formed between the inner skin of the above-mentioned yoke assembly 35. Therefore, the above-mentioned shaft 38 will rotate by the revolving magnetic field to generate by switching in order the current sent through the above-mentioned coils 36a and 36b.

[0031]And this shaft 38 has extended from the rotor 37 to the above-mentioned frame 32, and the leading screw 38a is formed in the extension side peripheral part of this shaft 38. And the shaft 38 is supported movably by the above-mentioned metal bearing 34a and the resin bearing 34b at the both ends of the leading screw 38a, enabling free rotation.

[0032]The leading screw 38a is formed in the extension side of the above-mentioned shaft 38, and the geared parts 40a and 40b of the connecting part 40 have geared to this leading screw 38a. And the above-mentioned frame 32 is inserted in and built over the sub-guide axis 41 in parallel with the shaft 38. Light pressure ON of this sub-guide axis 41 is carried out to the pores 32e and 32f provided in the frame 32, and it is being fixed by adhesives. This sub-guide axis 41 is inserted in the above-mentioned connecting part 40. Therefore, with rotation of the shaft 38, the connecting part 40 will be guided in accordance with the sub-guide axis 41, and slide movement of the leading-screw 38a top will be carried out to shaft orientations. The inside 40c of drawing 1 is the spring material attached in order to keep good the meshing state

of the gear parts 40a and 40b and the leading screw 38a.
[0033]The above-mentioned connecting part 40 is a portion connected with the flexible region which drives with the stepping motor 31. For example, when a video camera is equipped with the stepping motor 31 of this example, a lens holder is connected with this connecting part 40, and a zoom lens and a focus lens are moved.
[0034]As shown in drawing 1 (a), the thrust spring 42 is contacted by the base end of the above-mentioned shaft 36, and load of the thrust precompression is carried out to it within the case body 33 by closing the mounting hole 33b of the above-mentioned case body 33 with the pressure plate 44 via the thrust pad 43.
[0035]Next, the operation is described, explaining the assembly procedure of the stepping motor of the above-mentioned example. First, as shown in drawing 1 (b), light pressure ON of the resin bearing 34b is carried out into the mounting hole 32d drilled by the above-mentioned frame 32. As shown in drawing 2, it equips with the metal bearing 34a in the mounting hole 32c drilled by the above-mentioned frame 32.
[0036]Next, the yoke assembly 35 is arranged to the shaft-orientations base end side of the above-mentioned frame 32, and the above-mentioned metal bearing 34a is inserted into the diameter reduction part 35b of this yoke assembly 35. At this time, as shown in drawing 1 (a), the yoke assembly 35 is arranged so that the opening side of the above-mentioned case body 33 may attend the frame 32, and so that this yoke assembly 35 may not contact the above-mentioned piece 32a of bending. The case body 33 has pasted the yoke assembly 35 beforehand.
Thereby, the peripheral part is covered.

[0037]And as shown in drawing 5, the overall length L from this base level B to the piece 32b of bending of the above-mentioned frame 32 is defined on the basis of the abutment

X of the thrust spring 42. Alignment is insured with the inside diameter D3 of the most-inner-circumference side F2 of the above-mentioned yoke assembly 35 on the basis of the inside diameter D1 of the above-mentioned metal bearing 34a and the resin bearing 34b, and D2, and it sets up so that these may be located on the same axle. welding fixed W In this state, as shown in drawing 1 (a) and drawing 3, make metal bearing 34a the above-mentioned frame 32 by laser welding from a three way. Thus, if laser welding is used, the thermal effect and material modification which can perform precise welding into a detailed portion, and are given to a weld zone can be lessened. Since it is using sintering metal bearing as the intermediate bearing 34a, this example can perform welding immobilization, is easy also for the sizing and can perform an assembly more easily.

[0038]Then, in the yoke assembly 35, the mounting hole 33b of the case body 33 is passed, and the rotor 37 is arranged. The shaft 38 of this rotor 37 is inserted in the above-mentioned metal bearing 34a, and that extension end is contacted by the above-mentioned resin bearing 34b. Therefore, the metal bearing 34a with which the pieces 32a and 32b of bending of the above-mentioned frame 32 were equipped, respectively, and the resin bearing 34b will support movably the both ends of the leading screw 38a formed in the above-mentioned shaft 38, enabling free rotation. Since the extension end of the above-mentioned shaft 38 is formed so that it may have the curvature faces R, such as a surface of a sphere, these curvature faces R will contact the above-mentioned thrust spring 43, and rotation of the above-mentioned shaft becomes smooth.

[0039]Next, as shown in drawing 1 (a), the thrust spring 42 makes the base end of the above-mentioned shaft 36 contact, and the mounting hole 33b of the above-mentioned case body 33 is closed with the pressure plate 44 via the thrust pad 43 to it. That is, load of the thrust precompression is carried out to the shaft 38 by this thrust spring 42 within

the case body 33.
[0040]It is made to insert in the above-mentioned frame 32, making the above-mentioned sub-guide axis 41 insert in the connecting part 40, and adhesion fixing of the insertion section is carried out to the frame 32. The geared parts 40a and 40b of the connecting part 40 are meshed to the leading screw 38a of the above-mentioned shaft 38, and the above-mentioned stepping motor 31 is completed. Grease is applied to the leading screw 38a.
[0041]welding fixed W As mentioned above, the metal bearing 34a on the frame 32 by carrying out, By preventing gap from the frame 32 of the metal bearing 34a, and the end part of the above-mentioned shaft 32 being contacted by the resin bearing 34b, and positioning it, an assembly becomes easy and load of the suitable thrust precompression for the shaft 38 is carried out.
[0042]The above-mentioned yoke assembly 35 did not contact the piece 32a of bending of the above-mentioned frame 32, but this yoke assembly 35 and the bearing assembly have broken off their relationship. Therefore, the assembly size error of the yoke assembly 35 cannot have an adverse effect on the above-mentioned thrust spring 42, and an assembly can simplify more also by this. Therefore, load of the suitable thrust precompression for a shaft can be carried out, there is no variation in thrust precompression, and the rotation stable in low-loss can be obtained. Since the above-mentioned yoke assembly 35 and the bearing assembly have broken off their relationship and impact load is not easily applied to the thrust spring 42 even if a metaphor shock is added, the spring performance of a thrust spring is maintainable good.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]one example of the stepping motor concerning this invention is shown -- (a) -- the -- a part -- a fracture top view and (b) -- the important section drawing of longitudinal section and (c) -- the left side view.
[Drawing 2]Drawing of longitudinal section showing the state where the frame of the stepping motor of this example was equipped with the intermediate bearing.
[Drawing 3]The explanatory view showing the welded situation of the intermediate bearing of the stepping motor of this example, and a frame.
[Drawing 4]The case of the stepping motor of this example is shown and, as for the left side view and (b), in (a), the front view and (c) are the right side view.
[Drawing 5]Drawing of longitudinal section showing the part positioning state of the stepping motor of this example.
[Drawing 6]The forming process and structure of a yoke assembly of this example are shown, [of a stepping motor] As for drawing of longitudinal section of the holding state according [(b)] to a metallic mold, and (c), in the perspective view of a resin layer molding state, the enlarged vertical longitudinal sectional view of (d) resin layer molding state, and (e), (f) is the top view of the completed yoke assembly and drawing of longitudinal section of the completed yoke assembly according [(a)] to the exploded perspective view of 4 sets of pole gear yokes.
[Drawing 7]Drawing of longitudinal section showing the coil mounting state of the yoke assembly of the stepping motor of this example.
[Drawing 8]The rotor of the stepping motor of this example is shown, as for (a), it is the drawing of longitudinal section, and (b) is the perspective view.
[Drawing 9]Drawing of longitudinal section showing an

example of the conventional stepping motor.

[Description of Notations]

31 Stepping motor

32 Frame

33 Case body

34a Intermediate bearing (metal bearing)

34b Thrust block (resin bearing)

35 Yoke assembly (stator)

37 Rotor

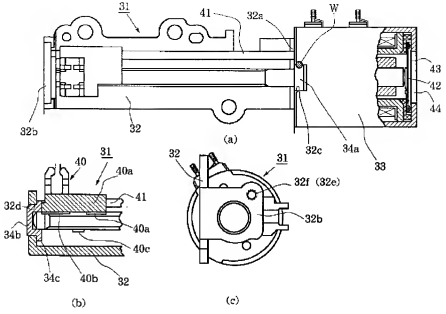
38 Shaft

42 Thrust spring

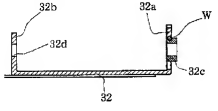
W Welding immobilization

DRAWINGS

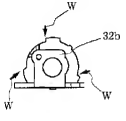
[Drawing 1]



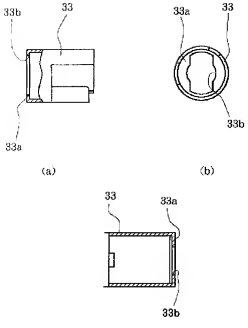
[Drawing 2]



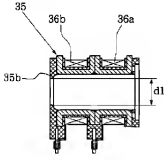
[Drawing 3]



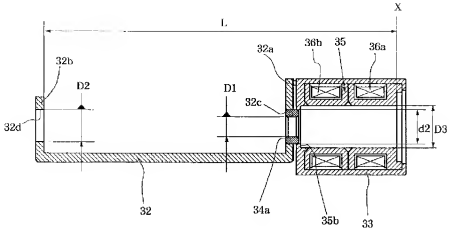
[Drawing 4]



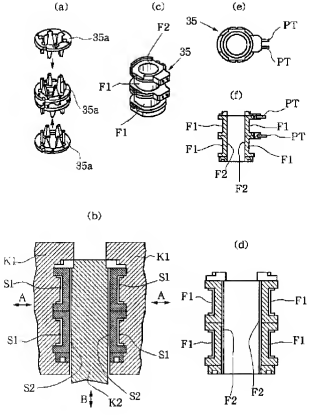
[Drawing 7]



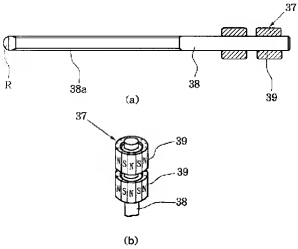
[Drawing 5]



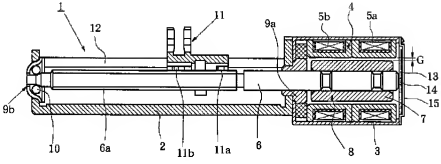
[Drawing 6]



[Drawing 8]


37
R
38a
38
39
(a)
37
39
39
38
(b)

[Drawing 9]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2
11b
11a
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8
3